

VARIATIONS IN *THAMNOPHIS ELEGANS* WITH DESCRIPTIONS OF NEW SUBSPECIES

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ABSTRACT.—Two new subspecies are described from the southern part of the distribution of *Thamnophis elegans*: *T. e. arizonae* from the Little Colorado River basin of Arizona and New Mexico and *T. e. vascotanneri* from the Upper Colorado River basin of Utah.

Few reptilian species in western North America occupy a geographical area as large and diverse as does *Thamnophis elegans*. Within this area Fitch (1983) listed six subspecies. Of these six, *T. e. vagrans* Baird & Girard (1853) is mapped as occurring in an area extending from southwestern Canada (Saskatchewan, Alberta, and British Columbia) southward in the high mountains and plateaus of the United States to Arizona, New Mexico, and Chihuahua, Mexico. Such a vast area includes a number of diverse basins including the Fraser River, Columbia River, headwaters of the Missouri River, Great Basin, Upper Colorado River basin, and smaller areas on the margins of some or all of these. It is not the intent of this study to report on populations from all of this area; only those in the eastern Great Basin, Upper Colorado basin of Utah, and the Little Colorado basin of Arizona are included.

Before examining the *Thamnophis elegans* populations, we discuss briefly some of the geological and climatic conditions that have involved these southern basins during recent geological times. The well-known distribution of *T. elegans* in its western high-mountain habitats of today was certainly not its primary situation during the recent ice age (see Wells and Jorgensen 1964, Van Devender 1977, Tanner 1978, Van Devender and Spaulding 1979, Morafka 1988). Other areas in North America, including the Mexican Plateau, were also similarly affected by the post-pluvial climatic events that induced degrees of isolation by environmental change and a reduction of available aquatic and mesic habitat (Taylor 1942).

For many years naturalists have recognized the uniqueness of populations inhabiting springs and streams in valleys that are separated by mountainous or desert barriers in the intermountain area of the western United States. This is true particularly of fishes in the Great Basin and many orders of aquatic insects as well as some reptiles. As Holocene desiccation advanced after the close of the recent ice age, many species primarily associated with mesic or aquatic valley habitats became confined to progressively smaller, more isolated aquatic or mesic areas and commonly at higher elevations.

In western North America—and particularly in Utah, Arizona, New Mexico, and northwestern Chihuahua—the advancing Holocene aridity not only affected those taxa associated directly with meadows and streams such as the garter snakes, but of course many other reptiles and mammals. Populations so involved often became confined to mesic mountain habitats at progressively higher elevations above wider expanses of developing arid and semiarid valleys and lower foothills below. Thus, as the pluvial period drew to a close and valleys and low ranges were progressively transformed during Holocene time into desert and desert-border habitats, *T. elegans*, including the “wandering” *vagrans* and other taxa that had previously been widespread in mesic valleys, became restricted to narrow habitats along permanent streams, at springs, in meadows and streams within the higher mountain ranges, and near the bases of these mountains.

The slow post-pluvial desiccation of the southern valleys in Utah and adjacent Arizona

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resulted in areas of desert that completely isolate animal populations in widely detached river valleys or basins. The deeper canyons, such as the Colorado and its southern tributaries, provided little productive streamside habitat, thus intensifying the isolation of riparian taxa. Two areas discussed below have been strongly affected by the restriction of habitat by the developing aridity. These are the Little Colorado valley of Arizona and the Upper Colorado River basin, including the areas both east and west of the river and north and south of the Book Cliffs in Utah and western Colorado. Between the San Juan River in southeastern Utah and the Little Colorado River in northeastern Arizona is an important arid and semiarid area with few aquatic habitats; it has been an effective barrier that continues to isolate populations to the north and south of it.

In the Little Colorado River valley eastward from near Winslow to St. Johns, Arizona, and southward into the headwaters of the Gila River is a population isolated from the *elegans* population in southeastern Utah and possessing characteristics not found in other populations in either Utah or Chihuahua, Mexico. Garter snakes from this area are characterized in part by a wide middorsal stripe with few invading dark spots along its margins (Fig. 1). This racial distinction is in contrast to the population northward in southeastern Utah in which the dorsal stripe is completely obliterated in most and nearly obliterated in others by the numerous invading spots on each side of the dorsal stripe. The greatly increased size of the spots forms *dark bars across the dorsal stripe*, resulting in a series of dark and light spots rather than a dissected dorsal stripe; this pattern is accentuated in juveniles (Fig. 2, 3). Because of these distinctive color patterns, each population is readily differentiated from the subspecies *T. e. vagrans* in the eastern Great Basin of Utah and beyond, within which taxon they have been included in previous studies (Fitch 1983). We describe below the population in the Little Colorado basin.

Thamnophis elegans arizonae, n. subsp.

HOLOTYPE.—BYU 13358, an adult female taken in a marsh approximately 2 miles east of Joseph City, Navajo Co., Arizona, 20 April 1956, by W. W. Tanner.

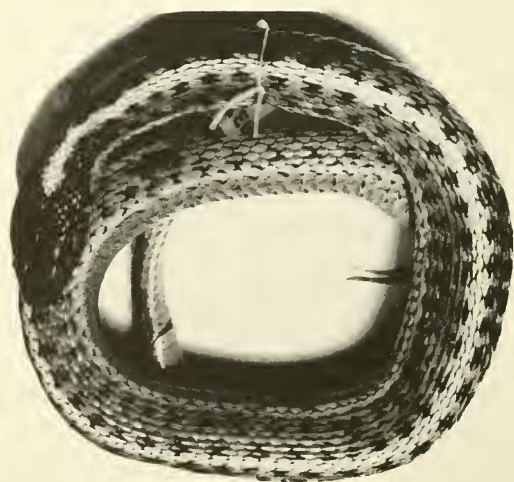


Fig. 1. *Thamnophis elegans arizonae*: top, BYU 13358; bottom, BYU 13249. Both from 2 mi E Joseph City, Navajo Co., Arizona.

PARATYPES.—ARIZONA: *Apache Co.*: UAZ 33528, Canyon de Chelly Natl. Mon., upper canyon del Muerto, 2 mi S and 3.7 mi W St. Ann Church (Tsailé); UAZ 33635–36, Canyon de Chelly Natl. Mon., upper canyon del Muerto, below Tsailé Lake Dam; UAZ 35918, 4.3 mi (on U.S. 180) W St. Johns; UAZ 37458, 37460–67, Crescent Lake, ca 21 mi (rd) SW Eager; UAZ 37470, Basin Lake, ca 22 mi (rd) SW Eager; UAZ 39493, 4.3 mi (on U.S. Highway 666) S St. Johns. *Navajo Co.*: BYU 12786–91 topotypes; BYU 13355–57, 4 mi E Shumway; UAZ 41861, 1 mi S Pinetop. NEW



Fig. 2. *Thamnophis elegans arizonae*: UAZ 3943, 4.5 mi S St. Johns, Apache Co., Arizona.

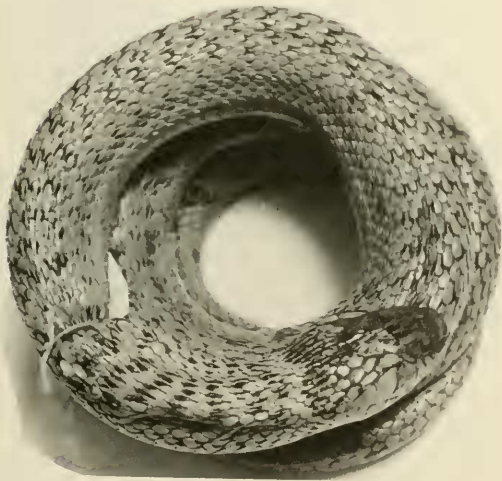


Fig. 3. *Thamnophis elegans vascotanneri*: BYU 10245, junction of Boulger Creek and Huntington River (now submerged by Electric Lake), Emery Co., Utah.

MEXICO: *Catron Co.*: UAZ 36370, Berland Lake, 17.4 mi SW U.S. 666 and ca 10 mi S Newcomb; UAZ 43145, Romero Creek, S of road crossing 10.4 mi NW Luna; UAZ

43141-42, Tularosa Creek S hwy crossing 13.1 mi (rd) E Reserve; UAZ 43196, Jenkins Creek at ca 8,600 ft W Spier Lake Basin. *McKinley Co.*: UAZ 36370, Berland Lake, 17.4 mi SW U.S. 666 and ca 10 mi S Newcomb; UAZ 36372, Marchy Lake, 15.7 mi SE U.S. 666 and 10 mi S Newcomb.

DIAGNOSIS.—Characterized by a broad middorsal stripe, usually 2-3 scales wide and with small marginal dark spots not or only slightly invading the dorsal stripe, stripe expanded above the angle of the jaws (Fig. 1). Ventrals 150-174, male 163-174 (166.4), female 156-165 (160.6); caudals, 68-92, male 80-92 (86.4), female 68-84 (75.0).

DESCRIPTION OF HOLOTYPE.—An adult female with a total length of 833 mm, tail 197 mm and 23.7% of total length; head length, snout to end of parietals, 21.6 mm; head width, 20.2 mm; dorsal scales in 21-21-17 rows, ventrals 162, caudals 77, supralabials 8-8, infralabials 10-10, preoculars 2-3, postoculars 3-4, loreal 1-1, temporals 1+2+3.

In the color pattern the light-colored mid-dorsal stripe occupies three scale rows. Small spots along its margins do not invade the stripe; midlateral dark spots are larger than those near the stripe, are irregular in shape, and have a fragmented appearance. Temporal spots are slightly darkened and divided by a single row of light scales extending from the dorsal stripe to the parietals. A lateral stripe on scale rows 2-3 is only slightly lighter than the first scale row; the first scale row is of the same light gray color as the ventrals, with a few small dark spots scattered irregularly along its margins (Fig. 1).

REMARKS.—There is little variation in the scale patterns. In the females the ventrals vary by only nine scales in a series of 20 specimens, and the scale rows are constantly 21-21-17. The oculars in the type at 2-3 and 3-4 are not normal; all others in the type series have 1-1 preoculars, but three other females have 3-4 postoculars. In the subspecies *vagrans* the small dark spots indent the margins of the dorsal stripe or dissect it; in *arizonae* these spots remain at the margin with few indentations.

A comparison of *T. e. arizonae* with specimens from western Chihuahua, Mexico (*T. e. errans*), indicates a similar enlargement of the middorsal light stripe posterior to the parietals. Posterior to the enlarged area the stripe

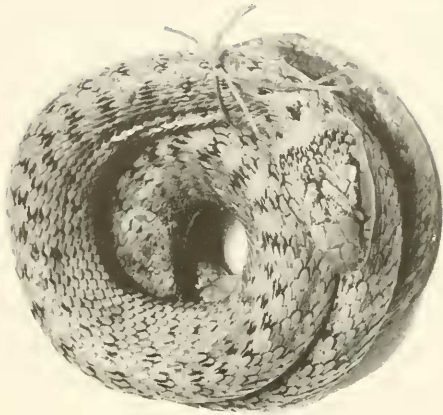


Fig. 4. *Thamnophis elegans vascotanneri*: BYU 544, Bryce Canyon Nat. Park, Garfield Co., Utah.

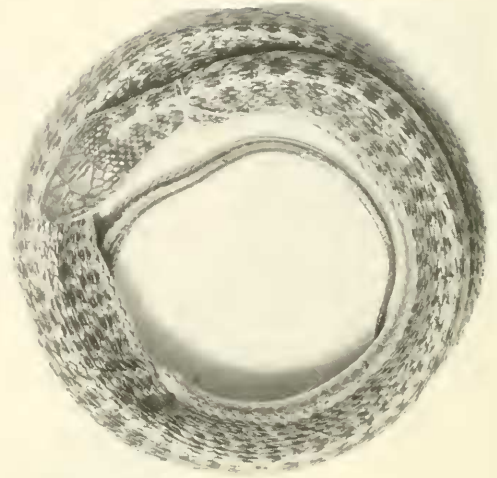


Fig. 5. *Thamnophis elegans vagrans*: BYU 16618, south side of Provo Airport, Utah Co., Utah.

narrows to involve only the middorsal scale row, forming a narrow stripe without the indenting (invading) of the stripe by dark spots along its margins (Fig. 4). Also in *errans* there are undulating dark bars on the body lateral to the dorsal stripe. These and other color pattern variables strongly indicate that these now widely separated populations (*vascotanneri*, *arizonae*, and *errans*) were, before the subcontinental desiccation, a single, widespread, interconnected series of populations. Only through isolation have color and scale patterns been modified. Specimens from New Mexico and those south of the Mogollon Rim in Arizona show characters that relate them to *errans*. (For additional information concerning *errans* see Tanner 1959, 1985 [1986], and Webb 1976.)

Thamnophis elegans vascotanneri, n. subsp.

Upper Basin Garter Snake

HOLOTYPE.—BYU 10245, an adult female taken at the junction of Boulger Creek and Huntington River, Emery Co., Utah, 18 June 1950, by Helen B. and Wilmer W. Tanner.

PARATYPES.—UTAH: *Carbon Co.*: BYU 2790, Price; BYU 23033, 1 mi N Price. *Daggett Co.*: BYU 205, 8834, Sheep Creek; BYU 511, 1608, 1610, Elk Park; BYU 14173, 5 mi E Clay Basin Station. *Duchesne Co.*: BYU 179, Neola; BYU 188, Duchesne; BYU 4058, 4078–82, Ioka. *Garfield Co.*: BYU 169, 1015–21, Escalante; BYU 170, 1022–24, 1029–30, 1859–62, 8318–20, Steep Creek,

Boulder Mt; BYU 171, 1925–27, 1936–37, Boulder; BYU 183, 1846, 1848–49, 1855–56, 1873, Posy Lake, Boulder Mt; BYU 664, Cyclone Lake, Boulder Mt; BYU 668, 1874–75, 2255, 2257–58, Escalante River at junction of Calf Creek; BYU 2131–32, 2740, 22473, Tropic; BYU 21708, Indian Creek (Moki area). *Grand Co.*: BYU 190, 1052, Green River; BYU 197, 1056, Moab; BYU 260, 1174, Blue Lake, LaSal Mts. *Kane Co.*: BYU 682–83, 1940–41, Orderville; BYU 8324, 11 mi W Kanab; BYU 30433, Findlay Ranch, 40 mi E Kanab. *San Juan Co.*: BYU 194, LaSal; BYU 196, LaSal Ranger Station; BYU 200, Bears Ears, Elk Ridge; BYU 11309, Redd Ranch, 3 mi W LaSal; BYU 13789–91, Kingalea Ranger Station, Elk Ridge. *Uintah Co.*: BYU 518, mouth of Brush Creek; BYU 11267, Tridell. *Wayne Co.*: BYU 176, 1028, Notom; BYU 663, 1857–58, Torrey; BYU 667, 1865–72, 3694, Fruita.

DIAGNOSIS.—Characterized by the absence or modification of the middorsal stripe by dark cross bars, leaving in some specimens only a series of light spots in the dorsal area. This is in contrast to the broad stripe in *arizonae* (Fig. 1) and the irregular, indented stripe in typical *vagrans* (Fig. 5). Ventrals 158–180, male 164–180 (171.5), female 158–170 (168.0); subcaudals 64–93, male 76–93 (85.8), female 64–85 (75.6).

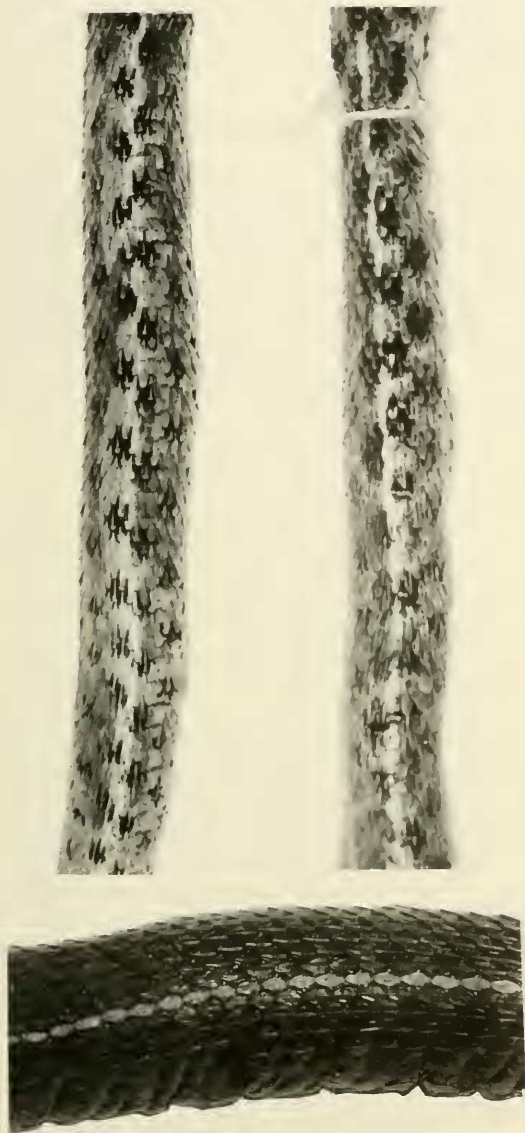


Fig. 6. *Thamnophis elegans vagrans*: top left and right, BYU 16618-16619, showing the irregular, zigzag dorsal stripe; bottom, dorsal view of *Thamnophis elegans errans*, BYU 17076, with a single scale row in the dorsal stripe, 2 mi S Creel, Chihuahua, Mexico.

DESCRIPTION OF HOLOTYPE.—An adult female with a total length of 983 mm, tail 186 mm with tip missing; head length 22.5 mm, head width 21.1 mm; dorsal scales 21-21-17 with the reduction to 17 at ventrals 165-168; ventrals 168, subcaudals 64, supralabials 8-8, infralabials 10-10, preoculars 1-1, postoculars 4-4, loreal 1-1, temporals 1+2+3.

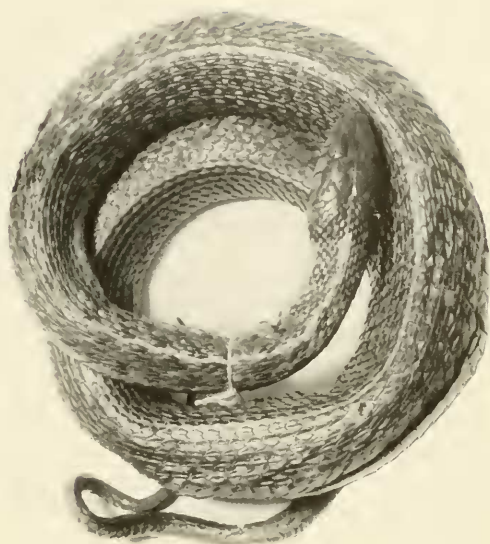


Fig. 7. *Thamnophis elegans errans*: BYU 17076, 2 mi S Creel, Chihuahua, Mexico.

The middorsal stripe is absent, with irregular dark cross bars spaced regularly on the dorsal and lateral surface (above lateral stripe) of the body. Ground color of body and tail a lead grey with the dark bars showing prominently, temporal spots joined medially and the same color as the dark body spots. Lateral stripe on rows 2-3, but not prominent, having only a lighter shade of grey than that of the body; ventrals a uniform dark grey; few widely spaced, small dark spots on the edges of ventrals and the first row of scales; head scales a light brown laterally and grey dorsally (Fig. 2).

REMARKS.—The determination by Fox (1948) that *T. ordinoides* and *T. elegans* were distinct species gave stability to the systematics of the *Thamnophis elegans* complex of subspecies. Furthermore, his data suggest also that *T. elegans* was, during and perhaps previous to the last pluvial period, a widespread and relatively uniform series of populations within the valleys of the intermountain west of North America. With the slow desiccation of the last 10,000 to 20,000 years, the extensive distribution once available to *T. elegans* has been dissected and constricted into smaller areas, with reduction or elimination of a contact between subspecies and local populations. Examples of this are seen in *T. e. errans*

of Chihuahua, which is separated from the Arizona–New Mexico *T. e. arizonae* by a wide expanse of arid desert and semiarid desert grassland, and is in turn similarly isolated from the *elegans* in the Upper Colorado River basin. In these subspecies, as well as *T. e. vagrans* and others, both the scale and color patterns have been significantly modified. Geographic isolation and a slowly changing habitat in conjunction with genetic isolation by distance are undoubtedly responsible for the observed changes in scale and color patterns.

When the type of *T. e. vascotanneri* was collected, the senior author did not immediately recognize it as an *elegans* and certainly not the same as the *e. vagrans* specimens seen in the Great Basin of western Utah. If the type locality of *T. e. vagrans* is in southwestern Utah (it is probably between Utah and Iron counties), then the more typical *T. e. vagrans* has a color pattern in which a yellowish mid-dorsal stripe is present and has on each side small dark spots that invade each edge. The invading, alternating spots on each side form a zigzag stripe (Fig 5). As indicated above, it is not our intention to report here on the entire series of populations of *elegans vagrans*. Those seen from the Great Basin, the Snake River, and the Columbia River basin of western Washington appear to have the basic characteristics of *T. e. vagrans*.

ETYMOLOGY.—The name *vascotanneri* honors the late Dr. Vasco M. Tanner. In the fall of 1925, Dr. Tanner arrived at BYU as chairman of the Department of Zoology, a position he held for 33 years. He had just completed his doctoral degree at Stanford University and, having been associated with David Star Jordan, was enthusiastic about the possibilities of natural history in Utah and the Great Basin. During the next few summers he took field trips to several parts of Utah; on one of these in southeastern Utah he collected perhaps some of the first reptile specimens of this subspecies. The low museum numbers for these specimens indicate the beginning of

the collection now housed in the M. L. Bean Life Science Museum. It is both fitting and our privilege to name this *elegans* subspecies in his honor.

ACKNOWLEDGMENTS

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